tigation of the sex-phenomena in the pea-crab, the female of which is known to be sedentary, spending its life imprisoned within bivalves such as mussels, cockles, and occasionally oysters. It was found that the female fulfils its mating functions probably once and for all (see NATURE, December 23, 1920, p. 533) when quite a tiny mite, and probably not more than a month or two old. It is unlikely afterwards that the female has any more need of a male. Now the same result—excepting for any advantage there may be in cross-fertilisation—might be obtained by the pea-crab being born as a male and changing into a female, and at the outset of the investigation such a change was suspected. It is, indeed, possible, that evolution in sex-characters in a similar species carried a stage further would end in cutting out the males of that species altogether—as has taken place in some Cirripedes—and leaving a hermaphrodite form which starts life as a male and changes into a female. In the case of the pea-crab, therefore, bisexuality is maintained by a very precocious association of the sexes, while the males still retain their active mode of life.

A similar dodge on the part of Nature has been applied in a large number of other cases, such as in some parasitic Copepods, some Echiuroids, some Cirripedes, some parasitic Isopods, and no doubt in many other cases. But in these cases the male is often minute and permanently attached to the female. It is clear, therefore, that it is necessary to be on the look-out for adaptations which retain in a species an appearance of bisexuality, but which bring about a close resemblance to the hermaphrodite state. The conditions which determine whether both sexual products shall ripen together in an individual or only successively are entirely unknown, but it is hoped that the suggestions put forward in this letter may help towards securing some information bearing on the problem.

J. H. ORTON.

The Laboratory, The Hoe, Plymouth,
October 20.

The Presence of Perennial Mycelium in Peronospora Schleideni, Unger.

SINCE *Peronospora Schleideni*, Unger, the onion mildew fungus, is known to produce its sexual organs in the leaves of the host-plant, the assumption has been made that the parasite is dependent on its oospores for perpetuation from year to year. It has now been proved, however, that the mycelium is capable of a perennial existence in onion bulbs, and that the shoots produced if such bulbs are planted are infected *ab initio*.

The presence of non-septate mycelium permeating the bulbs of the potato- and common onion, sent in from several parts of Ireland in the late spring of 1920, first directed attention to the subject. All attempts to induce this fungus to fruit on the bulb-scales, to infect other onions, or to grow on artificial media, met with failure. In some cases, however, where green leaves were present, the mycelium was traced from the bulb to the apical portion of a leaf on which conidiophores of *P. Schleideni* were being produced. All the infected bulbs shrivelled and died during the course of the autumn or winter, as did further infected specimens gathered in the autumn from badly diseased plots. Practically 66 per cent. of the smaller-sized onions from one particular plot which was badly mildewed in 1920 contained non-septate mycelium. Such infected bulbs sprouted prematurely, but although the mycelium grew up within some of the new shoots, it failed to develop conidiophores on the surface under winter conditions in the greenhouse.

Further material became available in the spring which proved the relationship of this fungus to *P. Schleideni*. Bulbs of the common onion (*Allium Cepa*) and of the shallot (*A. ascalonicum*) which contained the same non-septate mycelium were grown in the early spring under conditions which excluded the possibility of external infection, as proved by the fact that numerous control plants which were initially free from mycelium remained free from mildew, even when kept for a week under conditions favourable to the disease. The infected plants, on the other hand, when placed under a bell-jar for one night were found practically covered with mildew next day. In some cases the original infected leaves, which had not developed any mildew, were cut away. The new shoots which replaced them again came up permeated with mycelium and again became mildewed under favourable conditions, while similarly treated control plants remained healthy.

There is a time in the early spring, generally in the month of April, when the mildew is found only on onions the bulbs and leaves of which are permeated with mycelium. These plants appear to act as important centres of infection. For a long period no apparent harm results to the host, but the tips of the leaves ultimately turn yellow and droop. Under favourable weather conditions mildew then breaks out, at first just below the withered portion of the older leaves, and then on all the leaves except the youngest. There appears to be a nice balance between host and parasite, seeing that both can go on flourishing so long together, and that it is apparently only at a certain stage of maturity of the leaves that the internal mycelium breaks out into conidiophores. Even when this happens, the host-tissue is not killed for a considerable time.

Non-septate mycelium, apparently that of *P. Schleideni*, has been found in the bulbs of the common onion, in those of the potato- or underground-onion, and of the shallot. In the case of the common onion and shallot this mycelium has been definitely connected with the mildew fungus. It has also been proved that the mycelium survives when infected bulbs are left in the soil during the winter. This is possibly an important point in the case of Tripoli onions, which are sown in the autumn. The *rôle* of perennial mycelium in the shallot, potato-onion, and in onions grown from "sets" is obvious.

Plainly visible mycelium was observed in infected bulbs every time they were examined in spring, autumn, and winter. In these circumstances, it appears unnecessary to suggest the presence of mycoplasmic infection. It may be added that the mycelium is so obvious, the hyphæ being stout and well differentiated from the cells of the host-plant, into some of which large convoluted haustoria extend, that no better subject for demonstrating intercellular mycelium and haustoria is known to the present writer. No staining is required.

The effect of the fungus on the keeping qualities of infected bulbs requires further study, as do some other points in this strangelv overlooked phase in the life-history of such a common and destructive parasite.

PAUL A. MURPHY.

Royal College of Science, Upper Merrion
Street, Dublin, October 15.

The Development of Optical Industries.

IN NATURE of October 20, p. 238, Messrs. Zeiss's publicity manager questions a particular period of British supremacy in the manufacture of optical glass,

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and in doing so he minifies the value of Faraday and Harcourt's work. Of Harcourt he says: "The result at that time (between 1834 and 1844) was scarcely of any practical importance."

Now what does Dr. Zschimmer, who until the Revolution was chemist to Messrs. Schott, of Jena, say? I shall translate from his book, "Die Glasindustrie in Jena" (p. 22), and throughout I shall limit myself to quotations from German sources: "With Harcourt's experiments there began in the year 1834 the systematic 'scientific melting' of glass in the laboratory. He was the discoverer of the first research furnace for fusion at high temperatures, the first who was able to complete numerous small experimental melts, and thence to determine by spectrometer measurement the optical properties—refraction and dispersion—of various extreme glass substances."

On p. 23 he continues: "Harcourt . . . discovered the power of molten phosphoric acid and boric acid to form glass with almost all the elements, and on account of their fluidity he substituted them for the more viscous silica. Already in 1844 he was able to communicate to the British Association the happy success of his first experimental melts, the further object of which was to compare the chemical constitution with the optical properties of different glasses. . . ."

Dr. Zschimmer is generous, but not unduly so. A genuine man of science himself, he has recognised the great, far-reaching practical results of Harcourt's work, but Dr. Zschimmer has embarrassed us. In accepting his opinion we must doubt that of Messrs. Zeiss's representative, whose declared object it is to "furnish some trustworthy historical data."

Messrs. Zeiss's spokesman questions to-day the statement in NATURE that: "If the British optical industry is to be maintained and to develop so as to turn out products equal at least to the best products of other nations, it must not be dependent on foreign sources for the supply of optical glass, but must have an adequate home supply, equal, again, at least to the best available anywhere." "History," he says, "does not point to the existence of such a very close relation between the welfare of the glass-founder and of the optical instrument-maker in the same country."

Does it not? Is Messrs. Zeiss's publicity manager so unfamiliar with the history of the Jena establishments? If in the above statement from NATURE the word "German" be substituted for "British," we have the essence of the original appeals for a subsidy made to the Prussian Government. In this connection I shall translate part of a vigorous statement made by Rudolf Virchow: "It concerns itself, indeed, with a national undertaking, the object of which is to produce in Germany in an independent way the glass necessary for all scientific purposes, and also to provide for the population what is necessary for the production of spectacle glasses, opera glasses, and the like. Nevertheless the latter is not the principal object. It concerns itself, moreover, to the highest degree with the production of glass for telescopes, microscopes, and such like scientific instruments. This question is of very special importance as regards the construction of instruments for military and naval purposes, in which connection we have hitherto been entirely dependent upon foreign countries. In the previous year it was proven to the Budget Commission that only by a particular accident was it possible to obtain the necessary quantity of glass for the construction of optical instruments essential for the army."

"The close relationship between the welfare of the glass-founder and of the optical instrument-maker in the same country," thus forcibly advocated, was already recognised by the Prussian Government, which "granted to the Jena undertaking for two years a sum of 60,000 marks." JAMES WEIR FRENCH.

Anniesland, Glasgow, October 24.

THE letter published in NATURE of October 20 from the Carl Zeiss organisation in Jena through Messrs. J. W. Atha and Co. is interesting, but not very convincing, for Messrs. Zeiss seem to wish to convey a totally different impression from that of thirty-five years ago. Their present attitude is that although they did receive a small subsidy, a mere 3000*l*., from the Prussian Government, it was an isolated instance and really quite unnecessary. In view of this the following extract from the preface to the catalogue of optical glasses issued by Schott and Gen in 1886 is interesting:—"We have to express our sincere thanks to the Prussian Bureau of Education and to the Diet of the kingdom for the *very liberal and repeated subsidies* by which we were enabled to carry out the costly experiments on a manufacturing scale." The italics in the quotation are mine.

An analysis of the various optical glasses offered in this 1886 catalogue gives food for thought. Forty-four glasses were offered, of which it was claimed that nineteen were essentially new, and so were printed in heavier type. Fourteen of these were entirely withdrawn from the market within a year or two, as they were absolutely unstable, and were never replaced. Of the remaining glasses five had the following significant remark printed against them, presumably as a recommendation: "Exactly corresponds to the hard crown (soft crown, dense flint, etc.) of Chance Bros." Of the remaining glasses it may be said that they were merely slight modifications of the ordinary old-fashioned crowns and flints, having slightly lower or higher refractive indices than ordinary hard crown, light flint, or dense flint, and a correspondingly lower or higher dispersion, many of which had been produced by Chance years before.

MANSELL P. SWIFT.

81 Tottenham Court Road, London, W.1,
October 25.

IN their letter to NATURE of October 20 (p. 238), Messrs. Zeiss suggest, by implication, that British optical instruments are inferior to those of German manufacture. The following may be of interest:

I possess three photographic lenses. One a pre-war Goerz, double-anastigmat, 7-in. focal length, working at f/6·8, and two post-war Cooke lenses, one of 8¼-in. focal length, working at f/4·5, and the other of 15-in. focal length, working at f/5·8.

All three lenses have recently been tested at the National Physical Laboratory. The full reports are too lengthy for publication, but it suffices to quote that the Goerz lens had to be stopped down to f/16 to give "satisfactory definition over the entire plate," whereas the Cooke lenses did this at *full aperture*.

The Goerz lens, I was informed, was specially selected for me by Messrs. Goerz's agency in London, whereas both Cooke lenses were bought from stock at the Army and Navy Stores.

Possibly one important factor in the success of the German optical industry is the skilled way in which their products are advertised. The delusion that they are unequalled is widespread. K. C. BROWNING.

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